A REVIEW OF THE CARBONIFEROUS GONIATITE ZONES IN DEVON AND CORNWALL

by N. E. BUTCHER AND F. HODSON

ABSTRACT. A re-examination of existing museum collections of goniatites from the Culm Measures of Devon and Cornwall shows that most of the Carboniferous goniatite zones and subzones are represented in this region. The only zones for which there is at present no evidence are the *Eumorphoceras* and Lower *Gastrioceras* Zones.

ALTHOUGH Carboniferous goniatites have been known from Devon and Cornwall since they were figured and described by J. de C. Sowerby (*in* Sedgwick and Murchison 1840) and J. Phillips (1841), little modern work has been done on these faunas. The present study, largely a re-examination of existing museum specimens, most of which were collected fifty years or more ago, was initiated by N. E. B.; the identifications have been attempted by F. H. Much of the material is poorly preserved and precise identification has proved difficult in some cases. A description is given below of the main elements of the goniatite faunas from the Lower and Upper Carboniferous as they are now known.

Material. All the specimens referred to in this paper, with the exception of those in the collection of Dr. D. E. Owen, Keeper of the Manchester Museum, are deposited in the following museums, abbreviated in the text as indicated: BM—British Museum (Natural History). EM—Exeter Museum. GSM—Geological Survey Museum. NDA—North Devon Athenaeum, Barnstaple. SM—Sedgwick Museum, Cambridge. TM—Museum of the Torquay Natural History Society.

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LOWER CARBONIFEROUS

Strata of Lower Carboniferous age are found in relatively narrow outcrops on and near the northern and southern margins of the great central outcrop of Upper Carboniferous sediments. There are thus two separate east–west belts to be considered.

1. The Northern Belt. The Pilton Beds of north Devon contain a mainly trilobite–brachiopod fauna in which ammonoids are rare. From a study of the trilobites from the Barnstaple area Goldring (1955) proved the presence in these beds of the Upper Famennian *Wocklumeria* Zone (the topmost zone of the Devonian) and the basal Carboniferous

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Gattendorfia Zone. Goldring's discovery of *Gattendorfia* itself near Barnstaple confirms the latter correlation.

J. G. Hamling found several small ammonoids (TM Hamling Coll. 2190–1 and BM C19564–8) in black shales from two wells near Mount Sandford, 2 miles south-east of Barnstaple. These specimens are important in view of the fact that this locality is near the junction between the Pilton Beds and the succeeding Lower Culm Measures (see Hamling and Rogers 1910, pl. 33). Hamling (1908, p. 279) recorded them as *?Clymenia*, with which Paul (1937, p. 436) tentatively agreed, but Goldring (1955, p. 48) suggested they might be *Nomismoceras*. The poor state of preservation of these evolute forms unfortunately does not permit even generic identification. We are, however, indebted to Dr. M. R. House for his opinion that they are not Clymenids. It seems most probable that they are Prolecanitids (Pl. 17, fig. 1), and possibly of Tournaisian age.

Hamling also collected a goniatite (BM C19550) from the railway cutting west of Swimbridge Station. The locality is shown on Hamling's geological map of north Devon (Hamling and Rogers 1910, pl. 33) as occurring at the junction between the Pilton Beds and the Lower Culm Measures near Swimbridge. This specimen (Pl. 17, fig. 2) is identified as *Pericyclus* (*Rotopericyclus*) aff. *homoceratoides* Schindewolf which thus indicates the *Pericyclus* Zone of the German zonal scheme (Schindewolf 1951).

EXPLANATION OF PLATE 17

Fig. 1. Prolecanitid. From a well, 80 yards north of Venn Cross Quarry, near Barnstaple. TM Hamling Coll. 2190, ×2. The label on this specimen states 'south' of Venn Cross Quarry, but this must be an error (see Hamling 1908, p. 279). Goldring (1955, p. 48) has given the locality correctly with map reference SS 57883132.

Fig. 2. *Pericyclus* (*Rotopericyclus*) aff. *homoceratoides* Schindewolf. Railway cutting west of Swimbridge Station. BM C.19550, ×1½.

Fig. 3. *Merocanites* cf. *henslowi* (J. Sowerby). Westleigh, near Burlescombe. GSM 59906, ×1.

Fig. 4. *Bollandoceras microwotum* (Phillips) group. Doddiscombsleigh. BM C.9105, ×2.

Fig. 5. ? *Pericyclus sp.* or *Imitoceras ornatissimus* (de Koninck) group. Quarry east of Bableigh, near Barnstaple. NDA 789, ×1.

Fig. 6. *Sudeticeras* aff. *ordinatum* Moore. Spara Bridge, near Ashton Station. GSM US 1810, ×2.

Fig. 7. *Merocanites* aff. *applanatus* Frech. Codden Hill Quarry, near Barnstaple. NDA 823, ×¾.

Fig. 8. *Entogonites grimmeri* (Kittl). Just north of Canonteign, near Trusham. GSM US 1438, ×4.

Fig. 9. *Goniatites concentricus/striatus* group. Hele Quarries, ¾ mile south of Dulverton Station. GSM US 965, ×1½.

EXPLANATION OF PLATE 18

Fig. 1. *Goniatites crenistria* Phillips. Venn, near Barnstaple. TM Hamling Coll. 690, ×2.

Fig. 2. *Goniatites falcatus* Roemer. Hele Quarries, ¾ mile south of Dulverton Station. GSM US 963, ×2.

Fig. 3. *Goniatites sphaericostriatus* Bisat. Bonhay Road, Exeter. BM C.9111, ×3. (*a*) Ventral view, (*b*) lateral view.

Fig. 4. *Girtyoceras burlhennei* (H. Schmidt). Fremington. NDA 875c, ×1½.

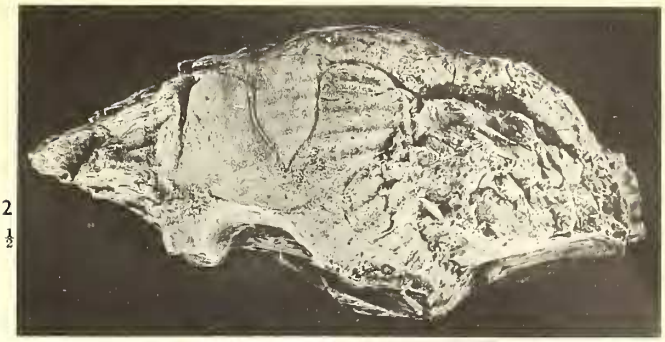
Fig. 5. *Goniatites bisati* Moore. Bampton. BM C.1641b, ×2.

Fig. 6. *Paragoniatites newsomi* (J. P. Smith) group. ¾ mile south of Ugbrooke House, near Chudleigh. GSM US 436, ×5.

Fig. 7. *Bollandites* of the *castletoneuse* (Bisat) group. Westleigh, near Burlescombe. BM C.9113, ×2. (*a*) Ventral view, (*b*) lateral view.

Fig. 8. *Goniatites* aff. *granosus* Portlock. Waddon Barton, near Chudleigh. EM Downes Coll., ×2.

1 × 2



2 × 1½

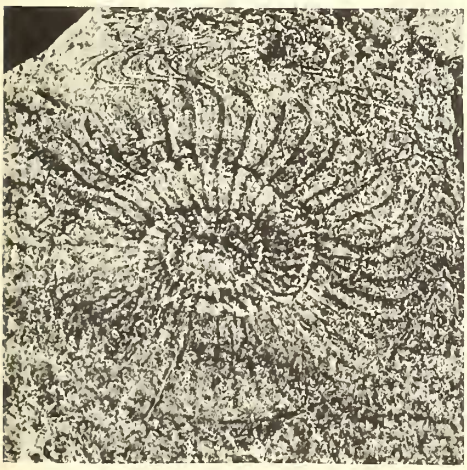
3 × 1

4 × 2

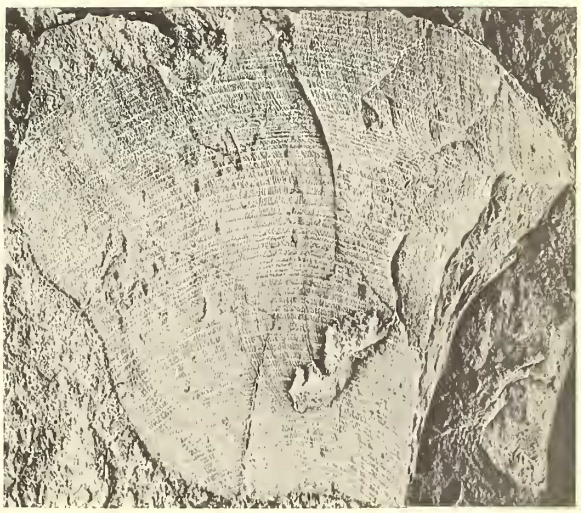
5 × 1

6 × 2

7 × ¾



8 × 4



9 × 1½

BUTCHER and HODSON, Carboniferous goniatites

1 × 2

2 × 2

3a × 3

3b × 3

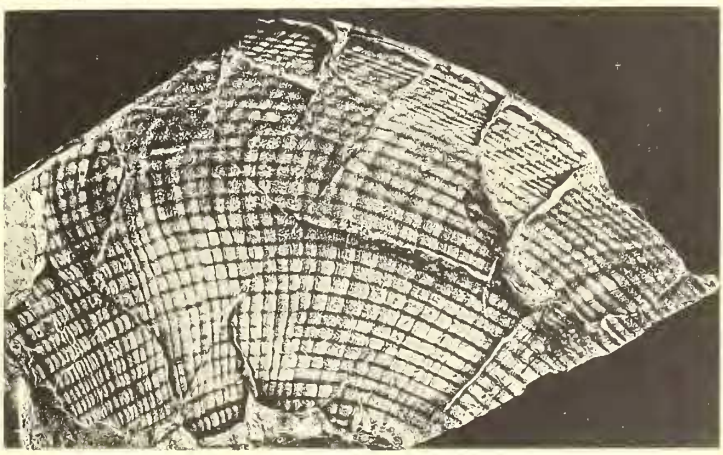
4 × 1½

6 × 5

5 × 2

7a × 2

7b × 2



8 × 2

It is possible that the Codden (or Coddon, see Woodward 1902, p. 481, footnote) Hill Chert Beds may in part be of *Pericyclus* Zone age, since several poorly preserved impressions of a coarsely ribbed goniatite referred to *Pericyclus sp.* (Crick, *in* Hinde and Fox 1895, p. 653) have come from these beds. Where the state of preservation allows it is seen that many of these specimens are involute. The best-preserved specimen (NDA 789 Partridge Coll.), from a quarry east of Bableigh, near Barnstaple, is illustrated in Pl. 17, fig. 5. These involute forms do not appear to agree with any of the figured and described species of *Pericyclus*. They may represent a new species of this genus or may even possibly belong to the *Imitoceras ornatissimus* (de Kon.) group, known from the *Pericyclus* reefs of western Ireland (Foord 1897–1903).

This coarsely ribbed goniatite is associated in the Codden Hill Beds with large, poorly preserved prolecanitids, the two forms having been found on the same bedding-plane (e.g. SM E16049). The latter have been referred to '*Prolecanites compressus*' (see Hudson and Turner 1933, p. 478). The specimens in the museum collections are too poorly preserved for specific identification, with the exception of one recently found loose in Codden Hill Quarry by Mr. C. Winzar. This large specimen (NDA 823, Pl. 17, fig. 7) may be referred to *Merocanites* aff. *applanatus* (Frech) which would suggest the B_1 zone.

The B_2 zone is certainly present at the eastern end of this northern belt near Burlescombe because the Westleigh limestones (Owen 1939) have yielded a *Bollandites* of the *castletonense* (Bisat) group (BM C9113 Vicary Coll., Pl. 18, fig. 7). *Merocanites* cf. *henslowi* (Sow.) (GSM 59906 Harding Coll.) also occurs at Westleigh (Pl. 17, fig. 3).

The subdivisions of the P_1 zone can now all be identified in these northern outcrops. The P_{1a} subzone occurs at the old Venn Quarry near Barnstaple where the limestones yielded *Goniatites crenistria* Phillips (TM Hamling Coll. 690, Pl. 18, fig. 1). The P_{1b} index fossil *Goniatites falcatus* Roemer was collected by Ussher from shales in Hele quarries, $\frac{3}{4}$ mile south of Dulverton Station (GSM US 963, Pl. 18, fig. 2). These quarries also yielded him a *Goniatites* of the *concentricus/striatus* group, also indicative of P_{1b} (GSM US 965, Pl. 17, fig. 9). The succeeding P_{1c} subzone is indicated by several specimens, collected from Fremington by T. M. Hall, of *Goniatites sphaericostriatus* Bisat, with which is associated *Girtyoceras burlhemei* (Schmidt) (NDA 875c, Pl. 18, fig. 4). Bampton is the type locality of Phillips' (1841) species, *Goniatites spiralis*. Bisat (1955) has redescribed material from this P_{1d} locality under the modern name of *Neoglyphioceras spirale*. J. E. Lee collected from Bampton a form which can be compared with *Goniatites bisati* Moore which would again indicate the P_{1d} subzone (BM C1641b, Pl. 18, fig. 5).

The P_{2a} subzone is suggested by some spirally ornamented goniatites collected by Dr. D. E. Owen from Whipcote Quarry near Burlescombe which approach *Goniatites granosus* Portlock (Owen 1949). This species was also collected by I. Rogers, from a locality near Yelland Farm, near Fremington. Higher Viséan subzones have not yet been recognized in these northern outcrops.

2. The Southern Belt. As in North Devon, the *Wocklumeria* and *Gattendorfia* Zones are now both known from the southern Upper Devonian and Lower Carboniferous outcrops. House and Selwood (1957) record the discovery of *Wocklumeria* near Launceston, and Selwood (1958) has in addition found *Gattendorfia* near this town. The beds containing these ammonoids are, on their lithology, referred to the Transition Series of Dearman and Butcher (1959).